QUALITY MANUAL

FOR THE

CHESAPEAKE BAY PROGRAM OFFICE

April 2020

U. S. ENVIRONMENTAL PROTECTION AGENCY—REGION 3
CHESAPEAKE BAY PROGRAM OFFICE
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1 MANAGEMENT AND ORGANIZATION

1.1 QUALITY ASSURANCE POLICY STATEMENT

The U. S. Environmental Protection Agency (EPA) initiated the Chesapeake Bay Program in 1977. Under Title I, Section 117 of the Clean Water Act (CWA), Congress directed EPA to establish a research program capable of defining historical water quality conditions in the Chesapeake Bay, characterizing current baseline conditions and developing computation and data management tools that would be used in future management of the Bay's water quality and living resources. The mission of the Chesapeake Bay Program Office (CBPO) is clearly defined under the Clean Water Act in § 117(b)(2), which requires that the EPA Administrator maintain the CBPO within EPA.

In 1983, the first of a series of formal, voluntary agreements among state and federal jurisdictions was signed – a simple, one-page document pledging the partners to work together to restore the Chesapeake Bay. In 1987 a second Chesapeake Bay Agreement was signed. Signatories to this Agreement formed the Chesapeake Executive Council, as directed by the 1987 Clean Water Act, to coordinate state and federal protection and restoration efforts. The Chesapeake Executive Council continues to develop new agreements and directives that prescribe specific goals, objectives and commitments for basin-wide restoration and protection actions. The 2014 Chesapeake Watershed Agreement is the most recent agreement.

The quality of the data generated under the auspices of the CBP Partnership shall meet or exceed all State, Regional and National Program Office requirements. This policy shall be implemented by ensuring that for all environmental data related efforts, adequate quality assurance procedures will be employed throughout the entire environmental data collection process from study design through data access. The CBPO will allocate sufficient funds to ensure that these policies are carried out.

1.2 ORGANIZATIONAL CHART

The CBPO is organizationally located under the Office of the Regional Administrator within EPA Region 3 (Figure 1). The Director is responsible for the overall program management, and the authority for managing quality assurance activities within CBPO have been delegated to the Quality Assurance (QA) Officer. The QA Officer is responsible for the development, implementation, and oversight of the CBP Quality Assurance Program. The CBPO funds a full time Quality Assurance Coordinator through an interagency agreement with the U.S. Geological Survey. Responsibilities for implementation of the CBPO Quality Assurance Program are distributed across a wide array of Project Officers, Goal Implementation Team Coordinators, Workgroup

Coordinators, and the Data Center Manager.

The CBP Quality Assurance Coordinator is responsible for coordinating quality assurance efforts among and between the CBP partners and reports directly to the QA Officer. In addition to the roles specified in the Regional QMP, the CBP QA Coordinator monitors performance of environmental laboratories through inter-laboratory quality assurance samples. S/he participates in the technical assessment of the coordinated split sample and the blind audit sample results and prepares or reviews summary and individual laboratory performance reports. The Coordinator summarizes, substantiates and presents the audit findings to the Data Integrity Workgroup, that is responsible for providing guidance on field and laboratory methods and QA/QC, resulting in accurate and comparable Chesapeake Bay and tributary water quality monitoring data. The QA Coordinator maintains electronic files of Quality Assurance Project Plans (QAPPs) and Standard Operating Plans (SOPs) for all environmental data collections programs funded by the CBPO and makes these documents directly accessible to data users through the CBP Partnership's web site. In addition, the QAC is responsible for updating this Quality Manual as and when necessary or at the very least reviewing the document annually.

The CBPO Grants Team Leader is required to take the annual on-line records management training and is familiar with records retention and management requirements. When needed, the Grants Team Leader coordinates with the Records Liaison Officer in the Philadelphia Regional Office (Region 3) to answer any questions staff may have pertaining to records management. Internal audits and self-assessments of grant files are routinely conducted by the CBPO Grants Team to ensure that quality assurance requirements have been met and documented in the grant files.

The Project Officers have the overall responsibility for ensuring that the recipients of federal funds implement the quality assurance activities required by EPA as stated in the *U.S. EPA Chesapeake Bay Program Office Grant and Cooperative Agreement Guidance* (Grant Guidance) and documented with the individual assistance agreements. The Project Officers ensure all statements of work describe the intended use of environmental data to be collected so that specific guidance and criteria pertaining to the quality of the data can be given. Project Officers must obtain agreement from the CBPO Quality Assurance Officer/Coordinator on all matters affecting quality assurance but are ultimately responsible for resolving problems and deficiencies identified in technical reviews, audits and data analysis. In addition, Project Officers are also responsible for notifying the recipients of the QA requirements and ensuring that the QAPPs are approved prior to initiation of environmental data operations.

The CBP Goal Implementation Team Coordinators are responsible for ensuring that requirements of the Quality Assurance Program are identified during team meetings and in activities sponsored by the teams. The Coordinators ensure that

quality assurance is an integral part of each environmental data collection activity sponsored by the Goal Implementation Team. Coordination of quality assurance activities among numerous partner state and federal agencies, academic institutions, and organizations is accomplished through the Team and/or its workgroups.

The CBP Data Center Manager has the program management responsibility for ensuring all the environmental data generated through the monitoring programs and projects funded directly by the EPA CBPO or as matching funds have been subjected to an audit of data quality and will be documented as to known quality. This environmental data will be made publicly available through the Chesapeake Center for Collaborative Computing (C4) as an asset of the CBP. Additional responsibilities include:

- Ensuring security, stability and availability of the EPA network for the Annapolis office;
- Coordinating the public dissemination of Chesapeake Bay data with C4;
- Evaluating and implementing new technologies to address information technology needs; and
- Coordinating the implementation of the CBP target enterprise architecture

Figure 1. Chesapeake Bay Program Office Organization Chart

1.3 COMMUNICATIONS

Within the CBP there are many forms of communication for ensuring that quality assurance is integral to all environmental collection efforts. Project Officers are required to renew their Project Officer certifications every three years which includes the most recent requirements of the CBPO quality system. The Project Officers are briefed annually on changes to the Grant Guidance including changes to QA requirements, if applicable. These requirements are also communicated to grantees and assistance agreement holders via the annually updated Grant Guidance.

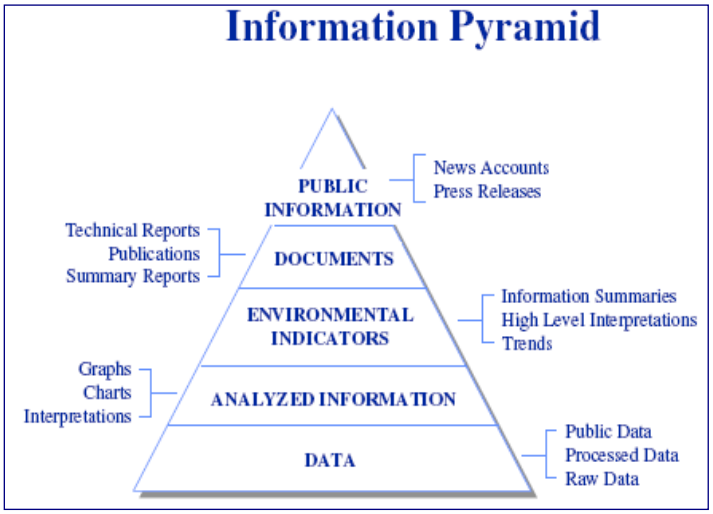
Once a submitted QAPP is approved, grantee reports are submitted quarterly or semi-annually and include any updates regarding the Plan's status. Further quality assurance and quality control documentation is required with the submission of data such as quality control sample results and metadata for the data themselves. If no changes are required to an existing QAPP, the funding recipient is expected to provide written documentation (e.g., a letter, an email) to the Project Officer or the QA Coordinator that a review was conducted, and no changes have occurred. Progress reports should include any changes to the QAPPs or SOPs; status of completion of outstanding quality assurance plans; significant quality problems, accomplishments, and status of corrective actions.

The Project Officer shall notify the CBPO QA Officer and the respective Goal Implementation Team Coordinator regarding the processing of the grant, interagency or formalized agreements during the planning phase. In addition, if the Project Officer identifies any problem areas the QA Officer is immediately notified. Necessary changes will be jointly outlined, and the Project Officer will institute the corrective actions. A follow-up review of the required changes will be made by the CBPO QA Officer and the Project Officer to verify that problems have been corrected.

The CBP Partnership's website is used to communicate Quality Assurance Program aspects to the public and to describe activities of the CBP Partnership's Data Integrity Workgroup. These websites contain information pertaining to quality assurance policies, guidance documents, meeting materials, consensus standards, decisions, etc.

The CBPO ensures the quality of publicly-released data and information products at each level of the Chesapeake Bay Information Pyramid (Figure 2). The quality of the stored data analyzed information and environmental indicators is well documented so that reports, websites and publications based on that information are credible and transparent.

Figure 2. Criteria for Publicly-Released Data and Information



2 PRODUCTS AND SERVICES SUPPORTED BY THE CBPO QUALITY SYSTEM

Work to improve the water quality in the Chesapeake Bay watershed is focused on the reduction of nitrogen, phosphorus, and sediment pollutants which are largely responsible for the Bay's water quality and habitat impairments. These pollutants come from many sources, including sewage treatment plants, city streets, development sites, agricultural operations, and deposition from the air. Several management decisions being made to accomplish the Chesapeake Bay restoration and protection ultimately require the use of environmental data produced by EPA and/or by the federal, state, local and academic partners. The collection, compilation, evaluation and reporting of environmental data are necessary to carry out the mandated CBPO functions (Section A.9.c). The major environmental programs and their associated products and services supported and/or influenced by the CBPO Quality System are summarized below.

2.1 MONITORING PROGRAMS

The CBPO Quality System supports major, long-term monitoring programs and networks that produce a substantial amount of environmental data which are compiled and maintained in centralized databases. The data are used for a variety of products and services such as: calculating compliance with the jurisdictions' Chesapeake Bay water quality standards; supporting Clean Water Act §303 (d) listings, evaluating trends; estimating nutrient and sediment loadings; creating

environmental indicators; calibrating environmental models; developing regulatory pollution budgets (e.g., TMDLs); and targeting expenditures of resources towards pollution sources and/or geographies for the most environmental benefit at the least cost. The major monitoring programs supported by the CBPO and its Quality System are:

- Chesapeake Bay Mainstem & Tidal Tributary Water Quality Monitoring Network;
- Chesapeake Bay Nontidal Watershed Surface Water Quality and Stream Flow Monitoring Network;
- Chesapeake Bay Watershed Biological Monitoring Program;
- Chesapeake Bay Shallow-Water Water Quality Monitoring Program;
- Chesapeake Bay Benthic Invertebrate Monitoring Program;
- River Input Monitoring for Loads and Trends in the major tributaries of the Chesapeake Bay;
- Monitoring and Assessment of Water Bodies in the Chesapeake Bay for Occurrence and Concentrations of Toxic Contaminants; and
- Chesapeake Bay Submerged Aquatic Vegetation Aerial Survey

2.2 MODELING PROGRAMS

The CBPO Quality System covers the environmental models and related decision-making support tools developed and used by the CBP Partnership. The quality and transparency of each model component is assured at various stages of development. Input data must be of known quality; model codes are tested and documented in permanent records; models are calibrated, and the output verified. All modeling activities, assumptions and management applications are subject to scientific, independent external peer reviews, and can be found on the CBP Modeling Team website. Examples of CBP model protocols and assessments are contained in the following documents:

- Airshed Model – estimates nitrogen deposited by vehicles, power plants etc.
- Land Use Change Model – predicts impact of urban pollution and development on sewer and septic systems
- Phase 6 Watershed Model – estimates nitrogen, phosphorus, and sediment reaching the Chesapeake Bay
- Estuary Model – examines effects of pollution load on water quality

2.3 BEST MANAGEMENT PRACTICES (BMP) VERIFICATION

Adopted by the CBP Partnership in October 2014, the Chesapeake Bay Basinwide BMP Verification Framework provides a structure by which Bay Program

partners ensure BMPs, treatments, and technologies for reducing nitrogen, phosphorus, and/or sediment pollutant loads are implemented and operating correctly. Verification can be viewed as a life cycle process that includes initial inspection, follow-up checks, and evaluation of BMP performance.

In 2017, each jurisdiction was required to develop a BMP Verification Program Plan – also known as a QAPP – for each pollutant source sector that has been reviewed and approved (at various levels of completion) by EPA by October 2018. In developing and assessing these QAPPs, jurisdictions and EPA followed five verification principles. The principles provide the common bar with which partners can judge the distinct components of the framework so that everything is aligned to hit the same mark in the end. The principles are specifically defined and cover 1) practice reporting, 2) scientific rigor, 3) public confidence, 4) adaptive management, and 5) sector equity.

Jurisdictions were required to clean up their records of historic BMP implementation for the period 1985 – 2017 and submit data through the NEIEN (National Environmental Information Exchange Network) – as is done annually for modeled progress assessments. For the first time in the history of the Partnership, each BMP has an assigned date of implementation along with a Partnership-approved lifespan as the credit duration for that practice.

All reported practices will expire at the end of their assigned lifespan and be removed from current crediting for nutrient and sediment pollutant load reductions in the accountability system unless a jurisdiction reports a BMP as having been verified as still in place and fully functioning. If BMPs are not operating according to specifications, the responsible party's maintenance and compliance programs are to remediate the situation and report that practice for continued crediting. As agreed to by the Partnership in our *2014 Chesapeake Bay Basinwide BMP Verification Framework*, this is the insurance that protects private and public financial investments, habitats, and drinking water, and improves the quality of our streams and the estuary.

EPA expects that reported BMP data follow the assurances of quality defined in each jurisdiction's EPA-approved BMP Verification Program Plan. The BMPs are to follow the definitions of the practices and control technologies as recognized for CBP purposes. Starting with the 2018 progress year, EPA expected that BMPs reported as new or re-inspected implementation are accurate with respect to the amount of fully-functioning BMPs, their location, and the dates of implementation and verification. As stated in the CBP Grant Guidance, BMP data reported through NEIEN are to be assured for quality, submitted no later than December 1, 2018, and cover the reporting period beginning July 1, 2017. BMPs reported through NEIEN (starting with the 2018 progress submission) that do not have and/or do not meet approved verification protocols will not be credited.

To ensure each jurisdiction has a robust operational BMP verification program, their QAPPs need to be updated when changes are made to their – or the CBP Partnership's – tracking mechanisms, the Basin-wide BMP Verification Framework, or methods for implementation accounting. The draft plans are, in turn, reviewed by EPA. When specific verification program elements are found to be needing further attention, they need to be addressed by the specific source sector in the jurisdiction. This protocol ensures BMP Verification Program Plans are up-to-date and follow the latest agreed-to principles established by the Partnership.

2.4 ENVIRONMENTAL INDICATORS AND INFORMATION

Environmental indicators are used by CBP managers to summarize pollution sources, ecosystem conditions, and trends toward meeting specific restoration goals of the Watershed Agreement. Assessments using Bay health and restoration indicators are incorporated into scientific and management publications, websites and accountability tracking systems.

CBP Goal Implementation Teams and workgroups have the lead responsibility to create and update CBP indicators. The work is coordinated through the CBP Partnership's Status and Trends Workgroup, whose members ensure that the CBP Partnership's indicators use the best available data and comparable analyses for each indicator. Status and Trends Workgroup: Procedures for Updating, Adapting & Establishing New Indicators | June 2016.

The quality and sources of data for each indicator is reviewed, documented and approved (Figure 3). All indicators are reviewed by the Accountability and Budget Team, the Communications Team and prior to release on the website Chesapeake Progress, and other Partnership publications such as the Bay Barometer.

Figure 3. Template for CBP Indicator Analysis and Methods Document (Revision 1, 9/9/2015)

Chesapeake Bay Program | Indicator Analysis and Methods Document
[Insert Indicator Title Here] | Updated [Insert Date Here]

Indicator Title:

Relevant Outcome(s):

Relevant Goal(s):

Location within Framework (i.e., Influencing Factor, Output or Performance):

A. Data Set and Source

(1) Describe the data set. What parameters are measured? What parameters are obtained by calculation? For what purpose(s) are the data used?

(2) List the source(s) of the data set, the custodian of the source data, and the relevant contact at the Chesapeake Bay Program.
- Source:
- Custodian:
- Chesapeake Bay Program Contact (name, email address, phone number):

(3) Please provide a link to the location of the data set. Are metadata, data-dictionaries and embedded definitions included?

B. Temporal Considerations

(4) Data collection date(s):

(5) Planned update frequency (e.g., annual, biannual, etc.):
- Source Data:
- Indicator:

(6) Date (month and year) next data set is expected to be available for reporting:

C. Spatial Considerations

(7) What is the ideal level of spatial aggregation (e.g., watershed-wide, river basin, state, county, hydrologic unit code)?

(8) Is there geographic (GIS) data associated with this data set? If so, indicate its format (e.g., point, line polygon).

(9) Are there geographic areas that are missing data? If so, list the areas.

(10) Please submit any appropriate examples of how this information has been mapped or otherwise portrayed geographically in the past.

D. Communicating the Data

(11) What is the goal, target, threshold or expected outcome for this indicator? How was it established?

(12) What is the current status in relation to the goal, target, threshold or expected outcome?

(13) Has a new goal, target, threshold or expected outcome been established since the last reporting period? Why?

(14) Has the methodology of data collection or analysis changed since the last reporting period? How? Why?

(15) What is the long-term data trend (since the start of data collection)?

(16) What change(s) does the most recent data show compared to the last reporting period? To what do you attribute the change? Is this actual cause or educated speculation?

(17) What is the key story told by this indicator?

E. Adaptive Management

(18) What factors influence progress toward the goal, target, threshold or expected outcome?

(19) What are the current gaps in existing management efforts?

(20) What are the current overlaps in existing management efforts?

(21) According to the management strategy written for the outcome associated with this indicator, how will we (a) assess our performance in making progress toward the goal, target, threshold or expected outcome, and (b) ensure the adaptive management of our work?

F. Analysis and Interpretation
Please provide appropriate references and location(s) of documentation if hard to find.

(22) What method is used to transform raw data into the information presented in this indicator? Please cite methods and/or modeling programs.

(23) Is the method used to transform raw data into the information presented in this indicator accepted as scientifically sound? If not, what are its limitations?

(24) How well does the indicator represent the environmental condition being assessed?

(25) Are there established reference points, thresholds, ranges or values for this indicator that unambiguously reflect the desired state of the environment?

(26) How far can the data be extrapolated? Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

G. Quality
Please provide appropriate references and location(s) of documentation if hard to find.

(27) Were the data collected and processed according to a U.S. Environmental Protection Agency-approved Quality Assurance Project Plan? If so, please provide a link to the QAPP and indicate when the plan was last reviewed and approved. **If not, please complete questions 29-31.**

(28) *If applicable:* Are the sampling, analytical and data processing procedures accepted as scientifically and technically valid?

(29) *If applicable:* What documentation describes the sampling and analytical procedures used?

(30) *If applicable:* To what extent are procedures for quality assurance and quality control of the data documented and accessible?

(31) Are descriptions of the study design clear, complete and sufficient to enable the study to be reproduced?

(32) Were the sampling, analytical and data processing procedures performed consistently throughout the data record?

(33) If data sets from two or more sources have been merged, are the sampling designs, methods and results comparable? If not, what are the limitations?

(34) Are levels of uncertainty available for the indicator and/or the underlying data set? If so, do the uncertainty and variability impact the conclusions drawn from the data or the utility of the indicator?

(35) For chemical data reporting: How are data below the MDL reported (i.e., reported as 0, censored, or as < MDL)? If parameter substitutions are made (e.g., using orthophosphate instead of total phosphorus), how are data normalized? How does this impact the indicator?

(36) Are there noteworthy limitations or gaps in the data record?

H. Additional Information (*Optional)*

(37) Please provide any further information you believe is necessary to aid in communication and prevent any potential misrepresentation of this indicator.

In addition to the major organizational products and services described above, listed below (Figure 4) are the other significant publication and information products that rely on the Chesapeake Bay Program Office's Quality System.

Figure 4. Chesapeake Bay Program Office Organizational Products and Services Covered by the Office's Quality System:

Programmatic:

1.) Chesapeake Bay Program Office Grant Guidance
2.) Best Management Practice Verification Plan
3.) Review and approval of responses to solicitations
4.) CBPO grants tracking system (CATS)
5.) Chesapeake Center for Collaborative Computing (C4)
6.) Chesapeake Bay Program website
7.) Bay Barometer
8.) Annual Health and Restoration Assessment
9.) Chesapeake Bay Water Quality Standards Assessments
10.) National Academy of Sciences Independent Evaluator
11.) Scientific and Technical Advisory Committee

Quality Assurance:

1.) Technical system audits
2.) Laboratory performance testing and evaluation
3.) QA review and documentation
4.) QAPP review and approval
5.) CBPO QA annual report and workplan (QAARWP)
6.) Methods and QA for Chesapeake Bay Water Quality Monitoring Programs

Scientific:

1.) Resource land assessments (GIS land layer models)
2.) Chesapeake Bay Program suite of modeling tools
3.) ChesapeakeStat

Data Outputs:

1.) Data Upload and Evaluation Tool (DUET) for automated verification of submitted data
2.) Chesapeake Bay Data Hub (data downloads for water quality and living resources)
3.) Land cover and GIS data

3 CBPO QUALITY SYSTEM AND DESCRIPTION

The CBPO maintains a formal Quality Management System to ensure that all environmental data and related information products generated under its funding purview are of adequate quality to support immediate and future management decisions. As a result, each EPA-funded project involving the acquisition of environmental data includes sufficient up-front planning for the development of well-defined project goals and data quality objectives. To achieve these objectives, quality assurance practices are incorporated into all phases of the environmental data collection, analysis, and reporting activities, from planning stages, through implementation, assessment and ultimately dissemination of the products and services.

3.1 CBPO QUALITY SYSTEM PLANNING

The planning process for monitoring begins with program-wide objectives and priorities which are documented in a comprehensive monitoring strategy. In 2008, the Chesapeake Bay Program's Scientific and Technical Advisory Committee, in conjunction with CBP Management Board, developed a process for evaluating the objectives and priorities for water quality monitoring programs. The full report is available on the Scientific and Technical Advisory Committee's website.

The monitoring objectives and priorities for 2010 and beyond are conveyed from the Chesapeake Bay Management Board to the Scientific, Technical Analysis and Reporting Team who recommends strategies and coordinates actions approved by the Management Board to accomplish management objectives.

Technical specifications for monitoring and data analysis are established by CBP workgroups, which consist of staff from EPA, state and federal agencies, academic institutions and non-profit organizations. For long-term projects, the CBP workgroups agree upon common objectives, designs, parameters, methods and quality assurance practices to ensure the consistency and comparability of data from multiple agencies and investigators.

Data from outside sources (i.e., secondary data) may be utilized following peer review and evaluation through the respective CBP workgroup. Hydrological, meteorological and agricultural data from USGS, NOAA and USDA are considered acceptable. Point-source and non-point source data generated by state and county agencies must have approved Quality Assurance Project Plans. Acceptance criteria for these secondary data sets are documented in the SOPs for point-source and non-point source data management.

3.2 CBPO QUALITY SYSTEM IMPLEMENTATION

Work processes are monitored through a collaborative effort between the

appropriate CBP Goal Implementation Team, Workgroup, and the Project Officer. Proposed projects are evaluated and approved through the Goal Implementation Teams and the CBP Management Board. Activities and outputs of the projects are presented to the respective Goal Implementation Team and Workgroup that actually use the information. Each of the projects is overseen by a Project Officer who is responsible for initiating the project, reviewing the progress reports, receiving applicable data and reports. Project Officers work in conjunction with the Goal Implementation Team and/or Workgroup to ensure that the project proceeds in the correct direction and generates the appropriate data and documents, in-line with the desired outcome. If a Project Officer, Goal Implementation Team, Workgroup or grantee decides to make changes to a project, the Project Officer documents the changes to the grant file and amends the grant if necessary.

Implementation of data collection operations is continually monitored. Monitoring data are submitted within 3-6 months of collection and pre-processed through automated data checks within 30 days. Annual data analysis and assessments provide further validation of the completeness of the data sets and the accuracy of the database.

3.3 CBPO QUALITY SYSTEM EVALUATION

The Quality Management System needs are supported by implementation of sufficient sampling design, collection, and analytical protocols such that the resultant data completely and accurately addresses the project's goals. The data must be of known and documented quality and have sufficient supporting documentation so that subsequent data users can evaluate if the data meets their data needs. The CBPO has instituted the following quality management systems to establish high data standards.

3.3.1 DATA MANAGEMENT

All routine water quality monitoring data generated through the CBP are submitted on a regular basis. For example, the State of Maryland and the Commonwealth of Virginia and their respective contractors are subjected to an Audit of Data Quality (ADQ). Before the Project Officer signs off on any submitted data set, monitoring data are run through a series of automated computer verification programs, called the Data Upload and Evaluation Tool (DUET). DUET permits data submitters to upload both regular data submission and special submissions to add or replace data already in the water quality database. After the data set is uploaded, it is placed in a processing queue. During processing, a text report is created listing each of the over 180 quality assurance checks and the records that fail each check. These reports are reviewed and approved by the CBP Water Quality Data Manager before a data set is imported to the

Chesapeake Environmental Data Repository (CEDR) and made available to the public.

3.3.2 TECHNICAL SYSTEMS AUDITS

All efforts must be made to produce data that is comparable to data collected previously and currently by other CBP grant, cooperative agreement, contract, and interagency agreement recipients and partners. Technical systems audits, which focus on the actual quality control in environmental measurement data collection systems, are performed at each laboratory and field data collection center involved in the generation of data funded by the CBPO. Technical systems audits are performed by the CBP QA Coordinator who is experienced in water quality chemistry, data collection technology and quality control procedures. The audit addresses an examination of calibration records, sampling and measurement procedures, general laboratory conditions, support systems, equipment and facilities, maintenance and repair records etc. Technical systems audits reports are submitted by the CBP QA Coordinator to the Director of the audited laboratory and/or field operation with copies to the appropriate State Project Manager as well as to the respective CBP Goal Implementation Team/Workgroup Coordinator and Project Officer.

Independent assessments of quality control operations are periodically performed to ensure that grantees are meeting data quality objectives. The CBP QA Coordinator conducts on-site technical audits periodically, or when unsatisfactory proficiency or quality control sample results are received. For new monitoring programs, readiness reviews are done to assess grantee capability to carry out field, laboratory and/or data management activities. Technical assessments of long-term monitoring activities are conducted to confirm that grantee QAPPs are being implemented.

Reports of corrective action are to be submitted by each facility to the CBP QA Coordinator within 45 days of receipt of the Technical systems audit report. Items not corrected will be brought to the attention of the funding recipient, Grants Manager, the Project Officer, the respective CBP Goal Implementation Team/Workgroup Coordinator and the CBPO QA Officer. The Project Officer has the authority to suspend or stop work in progress upon detection and identification of a situation affecting the quality of the results. In those cases, the CBPO Director and Region 3 Grants and Audit Management Branch Chief are notified.

3.3.3 PERFORMANCE EVALUATIONS

On a semi-annual basis, blind audit samples are distributed to the laboratories participating in the Chesapeake Bay Mainstem, Tidal Tributary and Watershed Water Quality Monitoring Networks. An effort is made to adjust blind audit sample instructions to allow the analysis of concentration ranges appropriate to the respective monitoring program's ambient monitoring levels. Ampoules are prepared with deionized water as diluents since only a select set of laboratories analyze saline samples. For particulate parameters, suspended matter is collected on glass fiber filters.

Results are returned by the laboratories to the CBP QA Coordinator for comparison with the current statistical estimates of the 95% and 99% confidence intervals. Audit sample performance is used along with independent technical systems audits to evaluate each laboratory's capability to accurately analyze the parameters of interest.

3.3.4 PEER REVIEW

An integral element of the Quality System at the CBP is the Data Integrity Workgroup that advises the Integrated Monitoring Networks Workgroup on field and analytical methodology and quality assurance issues. The performance and comparability of water quality monitoring methods is an ongoing activity of the Data Integrity Workgroup. The Data Integrity Workgroup is responsible for the Coordinated Split Sample Program and Blind Audit Program, which ensures that data from the different laboratories are comparable, and for the maintenance of program-wide Methods Manual. If corrective actions would affect the interpretation of subsequent data analyses, statistical analyses may be necessary to estimate the associated bias. All significant findings are reported to the appropriate CBP Goal Implementation Team/Workgroup, documented in the Data Integrity Workgroup's meeting summaries, and in the CBP Data Analysis Issues Tracking System. The Data Analysis Issues Tracking System (DAITS) is used to identify, investigate, resolve and document data anomalies that may affect the interpretation of the data.

The CBP Modeling Team progress and activities are internally reviewed at weekly meetings, as well as by the Water Quality Goal Implementation Team and its workgroups. In addition, model inputs are also reviewed quarterly by the CBP Modeling Workgroup, the Water Quality Goal Implementation Team and its workgroups at in-depth model review meetings. All CBP modeling activities, assumptions and related management applications are subject to scientific, independent external peer reviews. The CBP Scientific and Technical Advisory Committee

organizes these *external* reviews of CBP Modeling Team products as well as peer reviews of other monitoring and research activities.

3.3.5 MANAGEMENT ASSESSMENTS

The CBPO senior managers annually review and assess the adequacy of their quality system to meet the needs of the Office and the larger CBP Partnership. The management is responsible for ascertaining that appropriate CBP staff meet the minimum training requirements needed to perform their functional QA duties. The CBPO also maintains internal SOPs and QAPPs for functions ranging from processing grant awards to the management of submitted monitoring data. These documents are prepared in document control format and are submitted to the CBPO QA Officer for approval and maintenance in a permanent file. Where applicable, they are also kept in the grant file under which the data manager is funded.

In addition, the CBPO prepares a Quality Assurance Annual Report and Workplan (QAARWP) each year to be incorporated into the Region 3 QAARWP. Accomplishments and significant changes to the CBP Quality System are included in the QAARWP. Every three years EPA Office of Mission Support (OMS) Quality Staff conduct a routine, independent Quality Systems Assessment of the CBPO as part of the larger review of Region 3's Quality System. This involves a review of the components of the CBPO Quality System. The assessment and reported findings are done in conjunction with the OEI assessments of all Region 3 programs.

3.3.6 QUALITY IMPROVEMENT

All CBPO staff are responsible for quality improvement within their areas. CBPO senior managers communicate critical activities of the CBP at office-wide staff meetings and solicit input for improvements. The Associate Director for Science, Analysis and Implementation is responsible for the overall quality improvement program, the function of which is to identify the cause and consequence of a problem and suggest actions to prevent its recurrence. CBPO senior managers and team leaders also use the Goal Implementation Teams and Workgroups to continually identify, plan, implement and evaluate the quality and effectiveness of the work of the CBP Partnership.

4 INFRASTRUCTURE

4.1 PERSONNEL QUALIFICATION AND TRAINING

EPA and its other CBP partners have received training in the context of tasks and functions related to data quality for the CBP. In addition, they are required to draw upon their educational background, experience, professional symposia, and on-the-job training. Staff participates in technical workshops to share and expand their knowledge in their areas of expertise. Staff proficiency is demonstrated through workshop presentations, written reports, committee presentations and CBP publications. The CBP Quality Assurance Coordinator is qualified to perform all the necessary QA activities described in this document. In addition, the QA Coordinator is expected to comply with all the training requirements specified in the Regional QMP. Project Officers receive formal instruction from the Agency every three years to explain their legal assistance agreement oversight responsibilities. Project Officers who intend to approve Quality Assurance Project Plans must complete the requisite training and must be authorized to do so by the CBPO Quality Assurance Officer, who will document the completion of the required training.

4.2 DOCUMENTATION AND RECORDS

4.2.1 DOCUMENTATION

Every data set served by CBPO-funded data generators is accompanied by a related metadata file. This associated file documents the source of the data, the contact for additional information, the sponsoring and collecting organizations, the reasons for collecting the data, published documents or reports associated with the data, and other items. Documentation on database files is essential for drawing meaningful interpretations of the data contained in the database. In addition, database management is dependent upon structured, easy-to-use documentation. See the "Data Downloads" section of the CBP Data Hub at for a description of each monitoring program's data. The CBP Data Center Manager ensures that these tasks are performed (See §1.2).

Technical guidance and other quality-related documents are prepared by Workgroup members, peer reviewed and approved by the Scientific, Technical Analysis and Reporting Team, the Goal Implementation Team and/or Management Board. Once approved, guidance documents are given an EPA Document Control Number and filed electronically for future printings and revisions. The CBPO Administration Team is responsible for document control of all EPA and official CBP Partnership publications and reports. A listing of publications is maintained, and hard copies kept on hand in a publication "library" at the CBPO. For guidance

documents, only the most recent versions are available for distribution. Documents and publications are also available to the public on the CBP Partnership's website.

Documentation of data sources for publications available from the CBP Partnership's website is achieved by requiring data sets, reports and publications to have associated metadata. For database documentation, database managers are responsible for documenting and discontinuing the use of obsolete and superseded procedures. Data management standard operating procedures (SOPs) are reviewed annually to ensure that procedural changes have been incorporated. A listing of current SOPs and QAPPs follows.

Chesapeake Bay Program SOPs and QAPPs

(1) *Standard Operating Procedures for Post Award Monitoring for Grants and Cooperative Agreements*, March 2019.
(2) *Standard Operating Procedures for Processing Grant Award Applications*, March 2017.
(3) *Standard Operating Procedures for Managing Water Quality Monitoring Data*, October 2017.
(4) *Standard Operating Procedures for Managing Living Resource Monitoring Data at the Chesapeake Bay Program*, June 2013.
(5) *Standard Operating Procedures for Conducting Geographic Information System (GIS) Projects*, December 2011.
(6) *Quality Assurance Project Plan for Point Source Data Analysis*, March 2018.
(7) *Standard Operating Procedures for Non-Point Source Indicator Analysis*, July 2019.
(8) *Quality Assurance Project Plan for Tidal Trends Analysis Tasks*, April 2018.
(9) *Quality Assurance Project Plan for Watershed Effectiveness Data Analysis*, April 2018.
(10) *Quality Assurance Project Plan for Watershed Data Modeling*, March 2018.
(11) *Quality Assurance Project Plan for Estuarine Modeling Support*, April 2018.

4.2.2 RECORDS

The CBPO has adopted records management controls that are consistent with the U.S. EPA *Records Management Manual* (2160), i.e., records are classified, retained and disposed according to the specifications in this Manual. CBPO staff also must comply with the Project Officer's Manual

requirements which states “Record retention requirements apply to all supporting documentation, including documentation of significant actions and decisions, cost records, scope of work, correspondence, applications, pre-award reviews, quality assurance plans (i.e. QAPP, QMP), and funding decisions.”

The CBPO keeps official records in-house for at least one year after the closeout of the agreement and then sends the records to the Federal Records Center where they are destroyed when they are ten years old. The retention time has been extended from seven to ten years in accordance with 31 U.S.C. 3731, the statute of limitations on civil false claims cases. If litigation, claim, negotiation, audit, or other action involving the records was started before the end of the retention period, the records must be kept until either the completion of the action and resolution of all issues which arise from it, or until the end of the established retention period, whichever is later.

Quality assurance documents, data reports and interpretive reports submitted for grants and assistance agreements are placed in the corresponding files. Closed agreements are inventoried and disposed of or transferred to the National Archives in accordance with EPA's policy and guidance and federal statutes and regulations.

4.3 PROCUREMENT AND FINANCIAL ASSISTANCE

Most of the environmental monitoring data acquired and used by the CBPO are derived from approved grants and cooperative agreements. Interagency agreements may fund environmental data operations; however, these agreements are not competitively awarded. Contracts are very seldom used for environmental data acquisition.

Guidance for grant and cooperative agreement applications is developed as a collaborative effort among management, technical experts, and project officers in the CBPO, with input from the jurisdictional CBP partners. The CBPO Grant Guidance cites the quality assurance requirements for EPA grants and cooperative agreements that are mandated in 40 CFR Part 30.54 for universities and non-profits and Part 31.45 for states, tribal and local governments.

The Grant Guidance is reviewed, updated and distributed annually to existing and potential future recipients of CBPO funding. The guidance is also made available through the CBP Partnership’s website. Requirements for quality assurance and data deliverables are communicated to grant and cooperative agreement recipients through Requests for Proposals, the Grant Guidance, during workplan reviews, and in the final award terms and conditions.

The CBP Partnership may use data which are generated under the auspices of other EPA, federal, state, local, and non-governmental organization funding mechanisms. For data beyond the direct control or influence of the decision makers and users within the CBPO, staff actively works with Region 3 programs and with other funding partners to develop consistent guidance materials and Quality Assurance Project Plans.

All CBP Project Officer and Grant Managers follow work process designs that ensure a uniform application of requirements to all grants, contracts, cooperative, and interagency agreements involving environmental data. The CBPO has a system in place to review and approve proposals for grants and cooperative agreements. The process is initiated through extensive advertisement of a Request for Proposals (RFP) through website postings, hard copy and e-mail communications using a RFP mailing list. Once proposals are received, they are initially screened by the CBPO administrative team for deadline requirements, necessary applicant designations (e.g. nonprofit status), and other requirements specified by the RFP. After initial screening, eligible proposals are sent to a panel of three to five reviewers who rate each proposal on a predetermined set of criteria which is addressed within the RFP. Each reviewer is required to sign a conflict of interest form prior to initiating any proposal review. The ratings for each proposal and the review team's recommendations are sent to the CBPO Director for a final selection of the grant or cooperative agreement recipient(s).

Following the selection of the recipient(s) and proposal to be funded, the applicant(s) is required to submit a formal grant/cooperative agreement application. The application then goes through extensive administrative and technical reviews. Once the final award document is signed, work can begin on the project, however, the recipient must have an approved Quality Management Plan and Quality Assurance Project Plan in hand before environmental data collection or compilation work begins as described in the Regional QMP. Requirements for these plans are communicated to grantees and cooperative agreement holders via the CBPO annual grant guidance.

Post-award oversight by the CBPO is mandated through the CBPO Post-Award Monitoring Plan for Grants and Cooperative Agreements. This document describes in detail the duties of the Project Officer and supporting CBPO Grants Management Team as described in §1.2.

4.4 COMPUTER SOFTWARE AND HARDWARE

The Chesapeake Center for Collaborative Computing (C4) is the information system used by the CBP Partnership to collect, assemble, aggregate, provide quality assurance, and publicly disseminate Chesapeake Bay information. Implemented and managed through an EPA cooperative agreement, C4 is the authoritative source for CBP Partnership quality assured data. C4 supports,

manages, and centralizes the flow of data to and from CBP partners including federal, state and local agencies; academic institutions; non-governmental organizations; private organizations; and advisory groups and commissions.

CBPO funded data served through C4 are managed through provisioned hardware and software resources. This infrastructure uses industry standard guidelines and policies to ensure the efficient collection, storage and dissemination of CBP Partnership data. These data and processing requirements are used as the basis for determining the required infrastructure to be provisioned. The Data Center uses an industry-standard Agile application development process (Figure 5). Projects within the portfolio are managed in three-week sprints using an iterative design practice. Solutions evolve through collaboration between self-organizing, cross-functional teams utilizing the appropriate practices for their context. The workflow is monitored through daily scrum briefings.

The CBP Data Center utilizes four planning groups to manage application development and deployment. These include: Release Planning Board, Deployment Management Board, Sprint Management Board, and the Infrastructure Management Board. These groups plan all phases of each project's lifecycle from project planning to operations and maintenance.

The CBP Partnership has adopted data and information standards to improve coordination, compatibility, standardization, and access to data. Grantees, cooperators, contractors, and data servers are required to submit deliverables in electronic format. Electronic deliverables include reports, graphics, spreadsheets, imagery, data files, audio, and digital video products. All data and information, whether funded directly or indirectly by EPA, is considered public information and will be made available through the CBP Partnership's website. Standards for submitting data and information are documented in the CBP Methods Manual. In addition, specific guidelines for descriptive information, i.e., metadata, are documented in *Chesapeake Information Systems Metadata Reporting Guidelines*.

Chesapeake Bay database managers process data deliverables and identify deviations from reporting requirements. Database managers will contact the data generator directly to resolve minor errors; however, they consult with the appropriate Project Officer to resolve major reporting errors or omissions.

Figure 5. Agile Planning Flowchart for Application Development